115937

GENERAL MOTORS NORTH AMERICA
Safety Center

DEPT. OF TRANSPORTATION

00 NOV -8 PM 12: 24

November 06, 2000
USG 3591

Mr. Stephen R. Kratzke, Associate Administrator
Office of Safety Performance Standards
National Highway Traffic Safety Administration
400 Seventh Street, SW
Washington, DC 20590

Re: General Motors Comments to Docket No. NHTSA –2000-8011; - 4
Tire Testing – Federal Motor Vehicle Safety Standard (FMVSS No. 109)

Dear Mr. Kratzke:

General Motors Corporation (GM) greatly appreciated the opportunity to meet with some of your staff, as well as the NHTSA R & D staff, at our Tire and Wheel Systems laboratory in October 2000 on the matter of upgrading your FMVSS requirements for tire performance. GM believes that these discussions were very valuable in moving forward on this effort, and looks forward to future opportunities to continue this dialogue.

With the November 1, 2000 signing of the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act, H. R. 5164, your challenging work schedule has been clearly defined as stated in SEC. 10:
"**SEC. 10. ENDURANCE AND RESISTANCE STANDARDS FOR TIRES.**
The Secretary of Transportation shall conduct a rulemaking to revise and update the tire standards published at 49 C.F.R. 571.109 and 49 C.F.R. 571.119. The Secretary shall complete the rulemaking under this section not later than June 1, 2002."

It is the understanding of GM that NHTSA plans to collect tire test data prior to publishing a notice of proposed rulemaking (NPRM). The agency has opened a docket, NHTSA-2000-8011, under the 'Rulemaking' Category, entitled 'Tire Testing – Federal Motor Vehicle Safety Standard (FMVSS No. 109)'. The agency has published its test plan as item 1 in that docket. It is GM's understanding that the agency plans to use the subject test matrix in its effort to evaluate the high speed and endurance performance characteristics of current passenger car (P-metric) and light truck (LT) tires. The agency plans to use the data acquired from its testing to support its rulemaking proposal to upgrade FMVSS Nos. 109 and 119.

GM appreciates the opportunity to evaluate and comment on the agency's test plan. Based on GM's knowledge and many years of experience in tire development, testing and application on passenger cars, vans and light trucks, GM believes we can provide some useful comments.

Mail Code 480-111-S56 • 30200 Mound Road • Warren, Michigan 48090-9010
Phone: (810) 947-0149 FAX: (810) 986-8018

GM supports the agency's intent to evaluate and eventually develop an improved endurance performance test for current P-metric and LT tires using a test matrix comprehending varying parameters. The general method of high speed testing, in which load, inflation pressure, and ambient temperature are held constant while speed is increased at varying intervals, is a proven method of assessing tire performance. Furthermore, the variables being studied - load, inflation, speed, duration, and ambient temperature - are the primary parameters in tire high speed and endurance performance. The purpose should be to evaluate the influence of each of these parameters individually, and in combination, on the high speed and endurance performance of the tires. Some of the key points of our comments that we call to your attention are summarized as follows:

- In general, the objective for developing a test should be to assure that the component or system is designed properly to meet certain requirements. Current FMVSS have an excellent track record for assuring that performance is assured for endurance and high speed, i.e., the goal of assuring that the tires are designed properly is being met. If the agency tries to develop a test to assure that the tires after extended use will meet the same requirements as new tires, it needs to proceed with caution so that the goal of assuring the design is not affected, and other important aspects of tire design such as rolling resistance, wear, traction, ride, etc are not unnecessarily compromised.
- Tire design involves compromises between various primary performance properties of tires. A requirement of increased tire high-speed capability will likely result in compromises with mass, fuel economy and ride comfort.
- Correlation of laboratory test with performance of tires in the field environment is necessary. The tire performance on a flat-faced steel test wheel 1.7 meters in diameter at specified test conditions does not correlate directly with the same conditions on the road. It should be noted that a tire with an acceptable field performance history should serve as reference for acceptable performance on laboratory tests.
- Tests that take the tire to a failure can always be developed, but may not indicate poor performance. The test conditions proposed in the agency's test plan for high speed as well as endurance tests are much more extreme than the current SAE procedures. It is very likely that the proposed tests will result in testing to failure. Tire failures on these tests should not be interpreted as an indication of unacceptable performance.
- The test procedure should define what would be considered a failure.
- It is recommended that temperature be monitored throughout the test to gain insight into the tire performance prior to failure.

The detailed comments and suggestions regarding the agency's proposed test plan are offered for the agency's consideration and are provided in the attachment. GM also expects soon to provide additional comments to the docket regarding the tire standards upgrade effort.

If there are any questions, please contact me or Mr. Bhupen V. Shah on 810-986-2145 or Richard F. Humphrey in the GM Washington DC office on 202-775-5071.

Sincerely,

C Thomas Terry

C. Thomas Terry, Director
Safety Regulations and Consumer Metrics

Attachment
cc: Mr. George Soodoo, Vehicle Dynamics Division
Dr. Keith Brewer, Research & Development
Docket No. NHTSA-2000-8011

GENERAL MOTORS NORTH AMERICA
Safety Center

November 06, 2000
USG 3591
Attachment

# General Comments – Applicable to All Matrices

1. Tire design involves inevitable compromises between various primary performance properties of tires. These properties are carefully balanced in setting tire specifications for Original Equipment (OE) passenger cars and light trucks, to ensure that safety is maintained while customer desires are optimized. Increased tire high-speed capability results directly in compromises with mass, fuel economy (rolling resistance) and ride comfort. If tires are ultimately required to perform with significantly increased high speed performance, compromises will be made in these areas.

2. Since it is not possible or necessary to imagine and then test each combination of conditions that may be experienced by customers in the field, tests are typically developed to evaluate the tire's performance under conditions that tend to assess the primary failure modes. While the test conditions should be somewhat representative of field use in order to generate realistic failure modes, extreme test conditions are generally selected to accelerate certain failure modes. Thus, the conditions used represent a severity and duration combination beyond what is likely to occur in actual customer use.

   Correlation of laboratory test with performance of tires in the field environment is necessary. For example, the specified surface for the agency's testing is a flat-faced steel test wheel 1.7 meters in diameter, which is more severe at a given load, from an endurance and high speed standpoint, than a flat road surface due to the additional deflection of the tire in the test. While this is an accepted industry standard test platform, it is recognized that tire performance at a specified load/inflation/speed combination on such a test machine does not correlate directly with the same conditions on the road.

   For the above reasons, tire performance requirements for tires run on such laboratory tests will not correlate with any actual customer use and therefore should not be based on a desired duration of customer use at a combination of on-vehicle conditions. Instead, tires with known acceptable field performance should serve as reference for acceptable performance on such laboratory tests.

3. Tests that take the tire to a failure can always be developed but may not indicate poor performance. The current SAE J1561 and J1633 High Speed tests have been successfully used by the tire and vehicle industry for speed rating tires for a number of years. The statements made in item #1 above apply to these SAE tests. As depicted in the attached Figures 1 and 2, the combinations of test conditions for high speed tests proposed in Docket NHTSA-2000-8011-1 are much more extreme than the existing SAE procedure. As such, it should be expected that the proposed tests will likely result in testing to failure. Tire failures on these tests should not be

Mail Code 480-111-S56 • 30200 Mound Road • Warren, Michigan 48090-9010
Phone: (810) 947-0149 FAX: (810) 986-8018

interpreted as an indication of unacceptable performance. It is recommended that any publication of the results of this testing make this point clear. Similarly, the conditions for the proposed Endurance Tests are very extreme, as depicted in Figures 3 and 4.

GM believes a likely result of testing per these test matrices is that differentiation of tire performance may be minimal due to the extreme severity. That is, all tires are likely to fail at a number of the extreme conditions, and little or no comparative or performance information may be gained.

4. The definition of failure for these tests should be clarified. Inspection for evidence of various anomalies (separation, blisters, etc.) is specified in the proposed test procedure, but it is not clear what constitutes a failure. Since slight degrees of some of the anomalies listed may not be evidence that a full air-loss failure of the tire will subsequently occur, degree of anomaly constituting failure may vary depending on type of anomaly

5. It is recommended that temperature monitoring be included in the testing. By having the temperature data gathered throughout the test, more insight into the tire performance prior to failure may be attained. Several methods could be used. One such method would be to monitor contained air temperature using a transducer mounted through the rim. This would avoid instrumentation of individual tires.

## Specific Comments on NHTSA Docket Submission

## High Speed Test for P-metric Tires

6. For the High Speed P-metric test, the baseline test proposed in the test matrix is essentially the SAE J1561, or ECE R30 procedure. This test is being run at 25 °C. All other tests in this matrix are being run at 38 °C. GM suggests the agency run a test identical to the baseline test but at 38 °C so the impact of temperature alone can be isolated and understood.

7. It is not entirely clear which combinations of test conditions are to be run with a single tire. For the purposes of GM's comments, it is assumed that each block of conditions, without any extra line spacing, is one test using a single tire. This should be made clearer in the procedure.

8. The approach in the high speed matrices of testing each tire at increasing durations at a given load and inflation may make assessment of performance difficult. At a given load and inflation, a tire will be able to run for very long periods of time, nearly indefinitely, up to some speed. But when the threshold speed is exceeded, the tire has a finite structural life.

   Example: Referring to table 1, 2 or 3 of the agency's test plan, this example would apply to any two consecutive lines of any 3-line block of tests. Say tire #1 (T-rating at 190 km/h) fails during the 10 minute duration at its fourth test step (at 190 km/h), and tire #2 fails during the 20 minute duration at its seventh test step, but at a lower speed (step #7-180 km/h). Which tire has better high speed performance based on these results? Tire #2 may always fail at 180 km/h if the duration at that speed is sufficient, while tire #1 may be able to run indefinitely at 180 km/h.

A suggested alternative is to run the test as outlined but to use a new tire for each line of the test table. If a new tire was used for each line in the test table, further information can also be gathered by adding test speeds to go one or two speed increments (10 km/h each) above the speed rating of the tire.

9. No provision is made for Extra Load tires, which typically have 8-9% higher max loads, and are marked with a correspondingly higher inflation pressure. It is recommended that inflation pressures of +40 kPa be specified for testing these tires. This corresponds to the difference in the inflation pressure corresponding to the max load for Extra Load vs. Standard Load tires.

10. In the test description, Section 1-"Preparation of Tire", it is not stated if the tire is to be tested if evidence of any of the "defects" is present. If it is not to be tested, this should be noted. If it is to be tested, the location, type, and magnitude of the conditions observed during inspection should be recorded.

11. In section 2.6 of the test procedure, it should be noted that the ambient temperature for the baseline test should be maintained at 25°C ±5°C.

12. Per section 2.8, all tires will be tested as a "T" speed category tire or higher. Since many tires have speed categories below "T", these will be tested well beyond their design limits, and the resulting test may not provide much useful insight. See Table 1 for speed ratings per Tire & Rim Association (T&RA) yearbook.

    Similar to the suggestion in item 3, it is suggested that more information can be gained by testing each tire according to its speed rating, but extending the test beyond the rating if the tire completes the step equivalent to its speed rating without degradation.

13. At the end of section 2.8, the last word "or" appears to be extraneous.

14. In section 2.8.2, if an approximation of the tire operating temperature at end of test is desired, this should take place sooner than 15 minutes after the test. It should be practical to make this measurement within 1-2 minutes of test completion.

15. Requirements for information to be reported should be included in the procedure. In addition to all pertinent tire description information, it should include location and magnitude of any anomalies found during inspection. The extent of change in the

magnitude of these anomalies should also be noted if they were present in the pre-test inspection.

## Endurance Test for P-Metric Tires

16. Comments 7, 9, 10, 14 and 15 from High Speed Test for P-Metric Tires also apply to this test.

17. GM believes the combination of test load and inflation is resulting in an extremely overloaded tire, operating at high speeds. At 125% of the tire max load, and 160 kPa, a Standard Load tire is running at over 150% of its load limit per T&RA. If these extremes are to be included, some less strenuous combinations of load, inflation, and speed may be required to differentiate tire performance.

18. It may be difficult to determine the impact of the first test, since both test speed and inflation pressure are different from all other test conditions. It is recommended that only one parameter differ from all other tests so the results can be interpreted.

## High Speed Test for Light Truck (LT) Tires

19. Comments 7, 8, 10, 13, 14, and 15 from High Speed Test for P-Metric Tires also apply to this test.

20. The comment in #2 above regarding the extreme nature of loading in this matrix is most pronounced in the LT matrix. At 100% of max tire load and 260 kPa, the tire is approximately 23-24% overloaded for a C-load range tire. This matrix also does not take into account the higher load range tires. E-load range tires carry their max load at 550 kPa, and will be approximately 68-70% overloaded if run at 260 kPa without any load adjustment.

21. Comment #12 from High Speed Test for P-Metric tires also applies here, and is once again more extreme for LT tires, as these tires typically carry a much lower speed rating than "T". A typical OE LT tire carries a Q (160 km/h) or R (170 km/h) rating.

## Endurance Test for Light Truck (LT) Tires

22. Comments 7, 10, 14 and 15 from High Speed Test for P-Metric Tires also apply to this test.

23. Comment 17 from Endurance Test for P-metric Tires also applies here, but is more pronounced for LT tires. At 240 kPa, a C-load range tire is over 60% overloaded, and an E-load range tire is 125% overloaded. GM believes these test conditions are

so extreme that no significant learning may result from the tests.

If overloaded conditions are desired, it is suggested that the tire's load range be taken into account, perhaps by using a % under-inflation rather than an absolute.

24. Comment 18 from Endurance Test for P-metric Tires also applies here.

Table 1: T&RA SPEED CATEGORIES

| SPEED SYMBOL | SPEED CATEGORY |
|---|---|
| N | 140 km/h (87 mph) |
| P | 150 km/h (87 mph) |
| Q | 160 km/h (87 mph) |
| R | 170 km/h (87 mph) |
| S | 180 km/h (112 mph) |
| T | 190 km/h (118 mph) |
| U | 200 km/h (124 mph) |
| H | 2100 km/h (130 mph) |
| V | 240 km/h (149 mph) |
| W | 270 km/h (168 mph) |
| Y | 300 km/h (186 mph) |

November 06, 2000
USG 3591
Attachment

Figure 1

**High Speed Test Conditions**

**P-Metric Tire (S Speed Rating Example)**

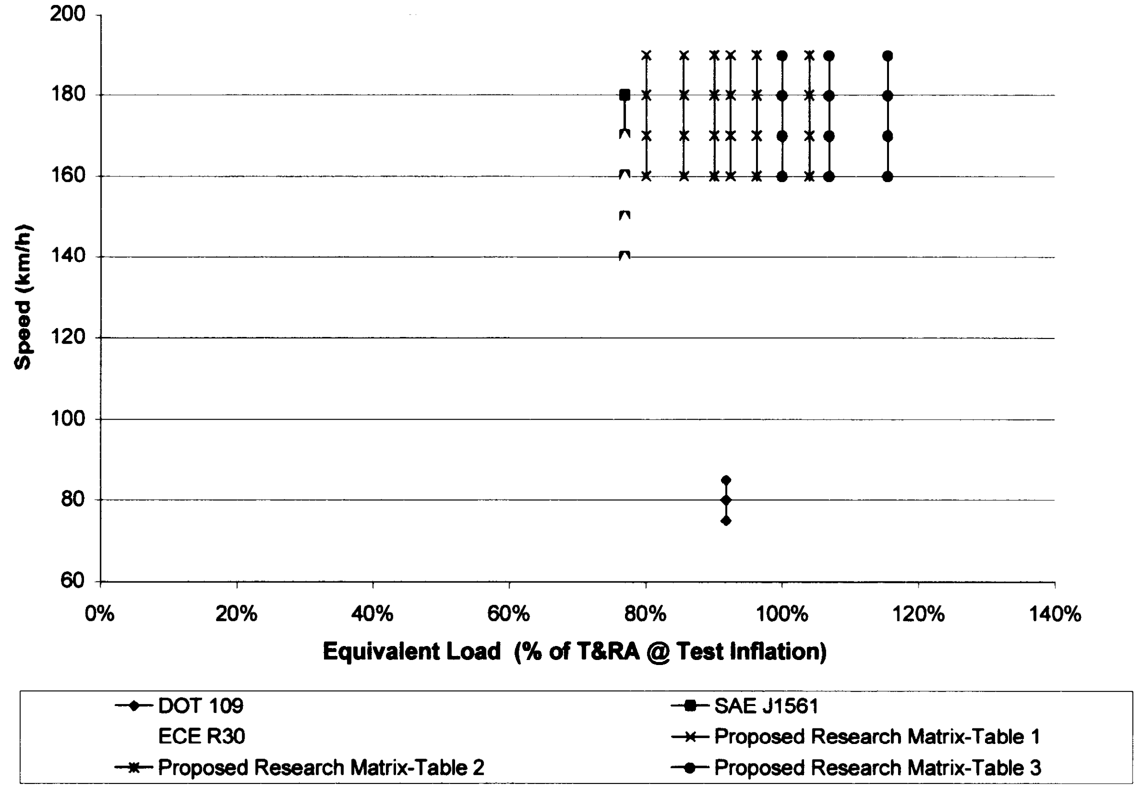


Figure 2

**High Speed Test Conditions**

**LT Tires (R Speed Rating Example)**

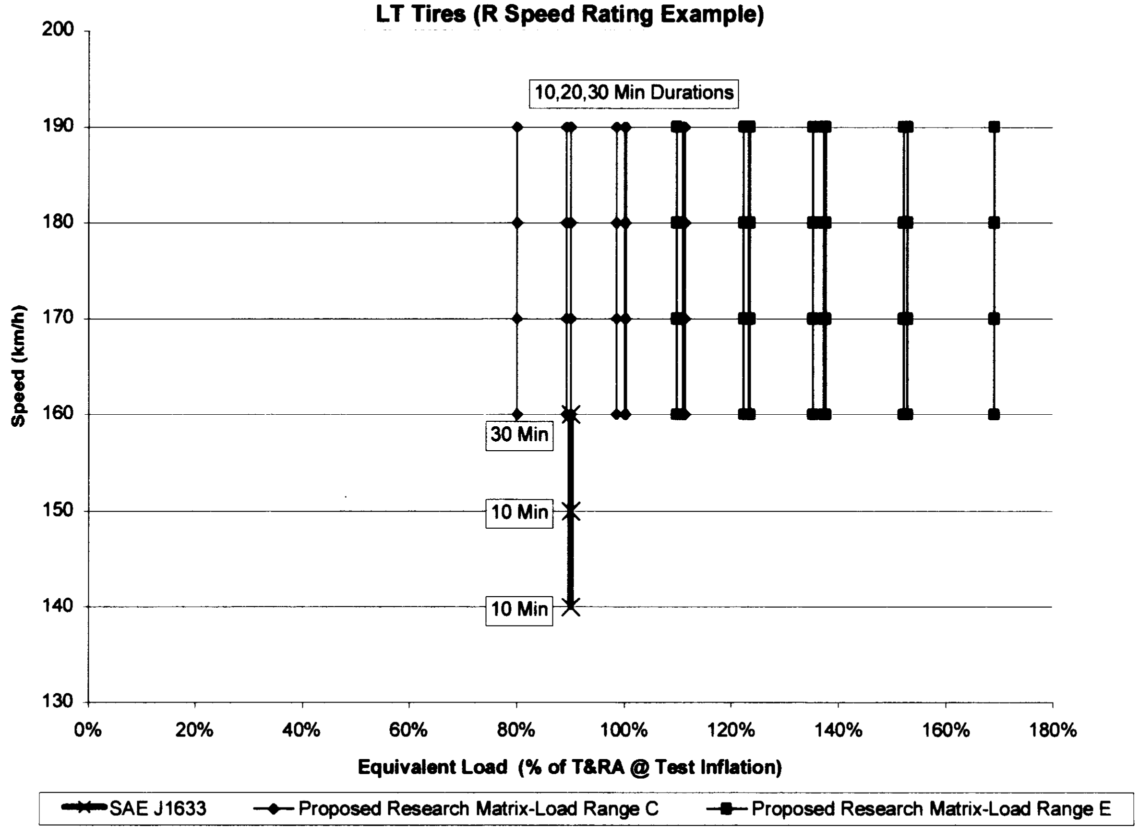

Figure 3

**Endurance Test Conditions**

**P-Metric Tires**

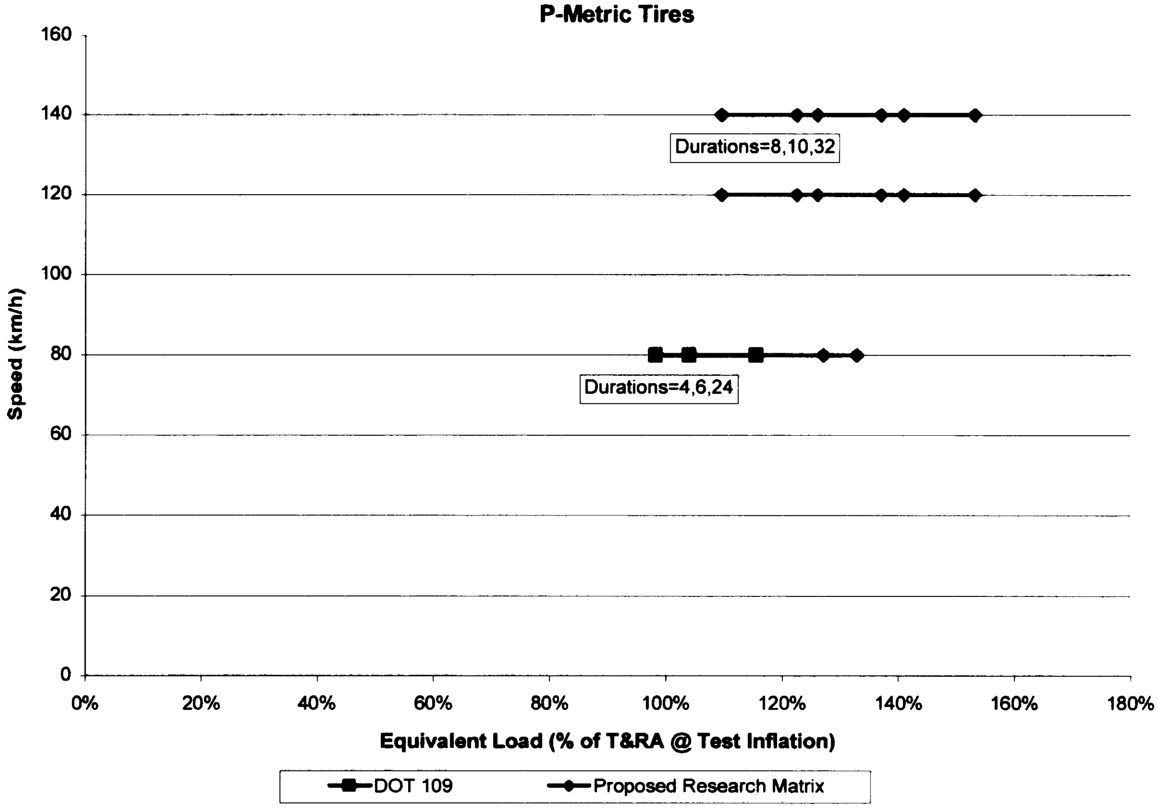


Figure 4

**Endurance Test Conditions**

**LT-Metric Tires**